

FOR INFORMATION ONLY

ACTION BY HIGHER HEAD-
QUARTERS PENDING



AD _____

RDT&E PROJECT NO. 1D141812D18506

USATECOM PROJECT NO. 4-4-5100-01

"SERVICE TEST

OF THE

AIRFIELD SPECIALIZED TRAILER SYSTEM"

Final Report of Test

by

Major Robert J. Wheeler
Mr. Raymond F. Cumb

31 OCT 1966

DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36360

Approved for public release;
distribution unlimited.

DDC Availability Notice

US military agencies ~~may obtain copies of this report directly from DDC.~~ Other qualified users shall request through Commanding General, US Army Material Command, Washington, D. C. This document may be further distributed by any holder only with specific prior approval of Headquarters, US Army Materiel Command.

Disposition Instructions

Destroy this report when it is no longer needed. Do not return it to the originator.

Disclaimer

The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents issued and approved by the Department of the Army. The use of trade names in this report does not constitute an official endorsement or approval of the use of such commercial hardware or software. This report may not be cited for purposes of advertisement.

⑨ Final Report Jul 64 - May 65

RDT&E PROJECT NO. 1D141812D18506

USATECOM PROJECT NO. 4-4-5100-01

⑥

SERVICE TEST
OF THE
AIRFIELD SPECIALIZED TRAILER SYSTEM

Final Report of Test

⑩ ^{ABV}

Major Robert J. Wheeler
Mr. Raymond F. Cumb

⑪ 31 Oct 66

⑫ 7/67

DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36360

⑯ RDT/E-1-D-141812-D-185,
USATECOM-4-4-5100-01

⑰

1-D-141812-D-18500

036500

A

✓

DDC Availability Notice

US military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through Commanding General, US Army Materiel Command, Washington, D.C. This document may be further distributed by any holder only with specific prior approval of Headquarters, US Army Materiel Command.

ABSTRACT

The US Army Aviation Test Board service tested the Airfield Specialized Trailer System (ASTS) to determine its suitability for Army use. Desert testing was conducted at Yuma Proving Ground, Arizona, during July 1964; low-temperature testing was conducted in the Climatic Laboratory, Eglin Air Force Base, Florida, during January - March 1965; and temperate testing was conducted at Fort Rucker, Alabama, during March - May 1965. Testing was suspended in May 1965 and cancelled in July 1966. The ASTS failed to meet the Proposed Small Development Requirements in 12 areas. Fourteen deficiencies and 12 shortcomings were discovered during the test. It was concluded that the ASTS in its present configuration is unsuitable for Army use. No recommendations were made.

FOREWORD

The Commanding General, US Army Test and Evaluation Command (USATECOM), directed the service test of the Airfield Specialized Trailer System by letter, AMSTE-BG, Headquarters, USATECOM, 11 March 1965, subject: "Test Directive, USATECOM Project No. 4-4-5100-01, Service Test, Airfield Specialized Trailer System."

The US Army Aviation Test Board (USAATB) was responsible for planning and conducting the test and for reporting the test results.

TABLE OF CONTENTS

	<u>Page No.</u>
SECTION 1 - INTRODUCTION	1-1
1.1. Background	1-2
1.2. Description of Materiel	1-4
1.3. Objectives	1-14
1.4. Summary of Results	1-14
1.5. Conclusion	1-17
1.6. Recommendations	1-17
SECTION 2 - DETAILS OF TEST	2-1
2.1. Introduction	2-3
2.2. Physical Characteristics	2-3
2.3. Operational Suitability	2-5
2.4. Ground-Handling Characteristics	2-15
2.5. Air Transportability	2-16
2.6. Maintainability and Reliability	2-17
2.7. Personnel and Training	2-19
2.8. Maintenance Package	2-19
2.9. Desert Test	2-20
2.10. Low-Temperature Test	2-22
2.11. Comparison with Proposed SDR	2-24
SECTION 3 - APPENDICES	3-1
I. Findings	3-I-1
II. Deficiencies and Shortcomings	3-II-1
III. References	3-III-1
IV. Distribution	3-IV-1

PRECEDING PAGE, BLANK, NOT FILMED

SECTION 1 - INTRODUCTION

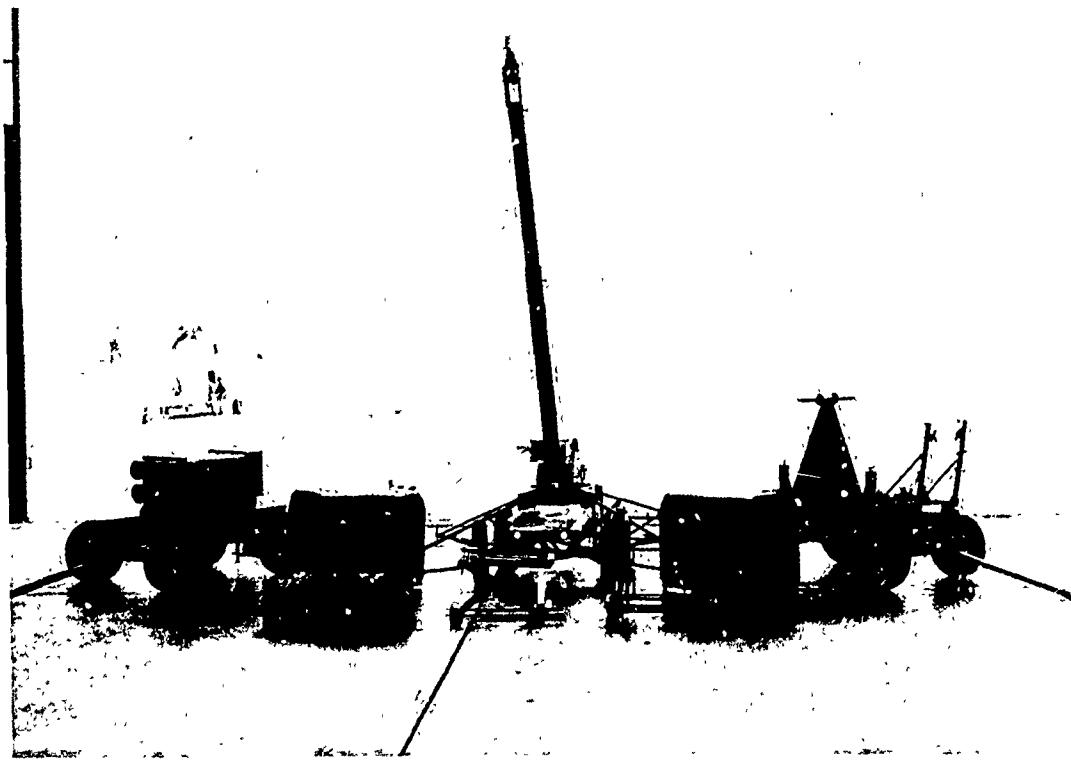


Figure 1. Airfield Specialized Trailer System.

1.1. BACKGROUND.

1.1.1. The Army has a requirement for a special-purpose trailer system for use on and around airfields to provide specialized operational support for aviation maintenance. The trailer system is to be used primarily for transporting aircraft assemblies and components and other ground-support equipment.

1.1.2. Studies in 1961 revealed that it was feasible for the Department of the Army (DA) to utilize a basic trailer which would be capable of accepting various adapters tailored to specific job requirements for Army aviation maintenance. A design competition was conducted and a contract awarded in 1962 for the design, fabrication, and testing of a prototype trailer and pallet.

1.1.3. On 23 March 1964, Headquarters, USATECOM, directed the USAAVNTBD to conduct a military potential test of the Airfield Specialized Trailer System (ASTS) (USATECOM Project No. 7-4-0458-01) (reference 2, appendix III, section 3). Initial testing was to be conducted under desert environmental conditions (reference 4, appendix III, section 3). The trailer portion of the ASTS was tested during the 1964 desert-test cycle. This test was inconclusive because some of the specialized adapters were not available. The project was cancelled on 9 September 1964 (reference 6, appendix III, section 3) after determination that a service test was required.

1.1.4. On 11 March 1965, the USAAVNTBD was directed to service test the ASTS to determine whether it was suitable for Army use when operated under simulated low-temperature, temperate, and desert environmental conditions (USATECOM Project No. 4-4-5100-01). The test program was to be conducted in two phases: the first phase devoted to testing under temperate and simulated low-temperature climatic conditions, and the second phase devoted to further desert testing. Before completion of testing, this project was suspended on 12 May 1965 (references 8 and 9, appendix III, section 3) because of the lack of an approved Small Development Requirement (SDR). Subsequently, a Draft Proposed SDR (reference 11, appendix III, section 3) and then a Proposed SDR (reference 12, appendix III, section 3) were received.

1.1.5. On 2 May 1966, the USAAVNTBD was directed to conduct a service test of the Model 689 Aircraft Maintenance Trailer using the adapters of the ASTS. Results were reported in reference 17, appendix III, section 3.

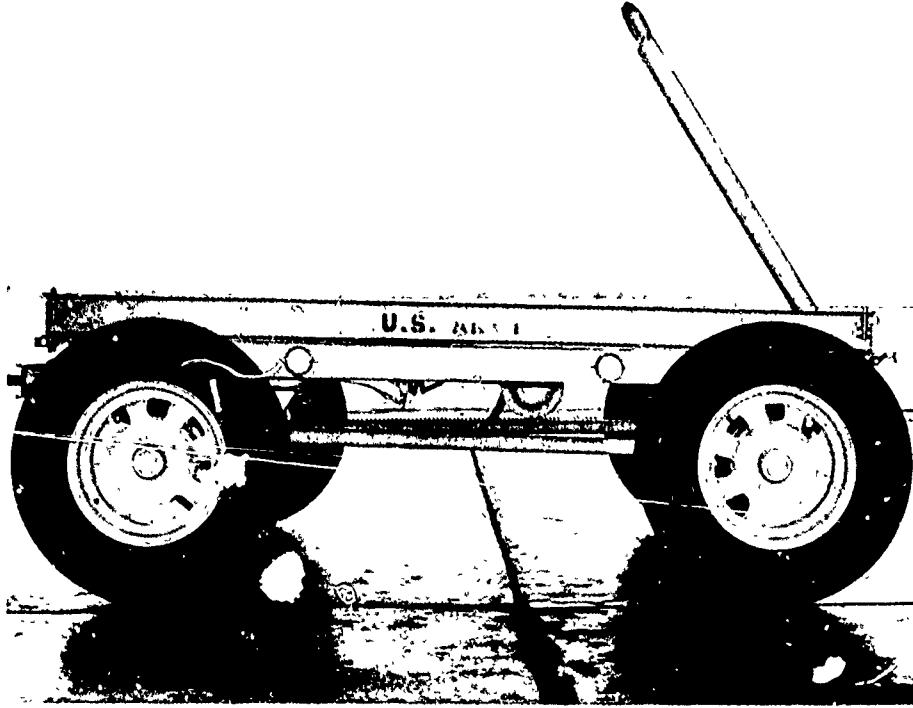


Figure 2. Universal trailer.

1.1.6. On 20 July 1966, USATECOM Project No. 1-4-5100-01 was cancelled because procurement of the item was no longer being considered. Submission of a report was directed (reference 16, appendix III, section 3).

1.2. DESCRIPTION OF MATERIEL.

The ASTS is a grouping of equipment designed to be compatible, one with the other, and includes a universal trailer, a universal pallet, and seven specialized adapters.

1.2.1. Universal Trailer.

The universal trailer is a lightweight, air-transportable, four-wheel trailer. It is capable of transferring loads to compatible maintenance and storage stands by a roller system. It can accommodate



Figure 3. Universal pallet with running gear and cover attached.

the universal pallet and any of the seven functional components. The trailer chassis is of riveted and bolted aluminum construction (box structure, I-beam rails, and transverse beams). The suspension system is a specially designed, three-point system which protects loads from excessive wheel displacement when moved over rough terrain. The trailer is capable of being towed or lifted.

1.2.2. Universal Pallet.

The universal pallet is constructed of lightweight steel and can accommodate hoist and lift facilities. Sockets are provided to permit attachment of several accessory kits (running gear caster, transfer rollers, covers, and skids).

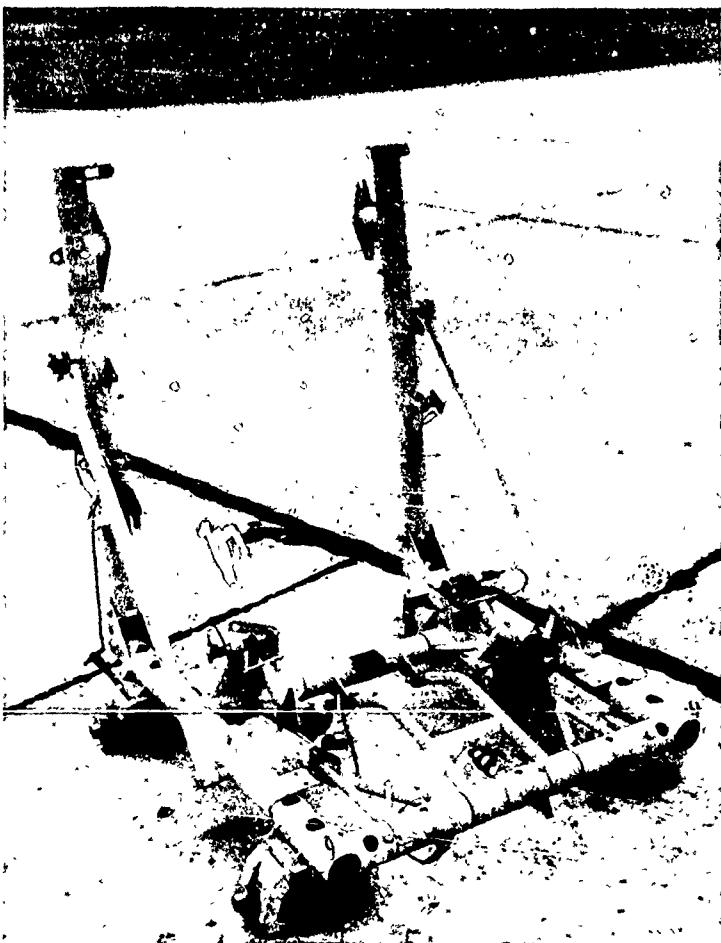


Figure 4. Engine adapter.

1.2.3. Engine Adapter.

The engine adapter is designed to accommodate the T53, T55, T63, and T64 series engines as they are used in Army aircraft. The adapter is basically a tubular-steel, square frame with two upright members. Studs and mounting pads are positioned to accommodate the engines listed above. The pads are secured by quick-disconnect pins and are color coded.

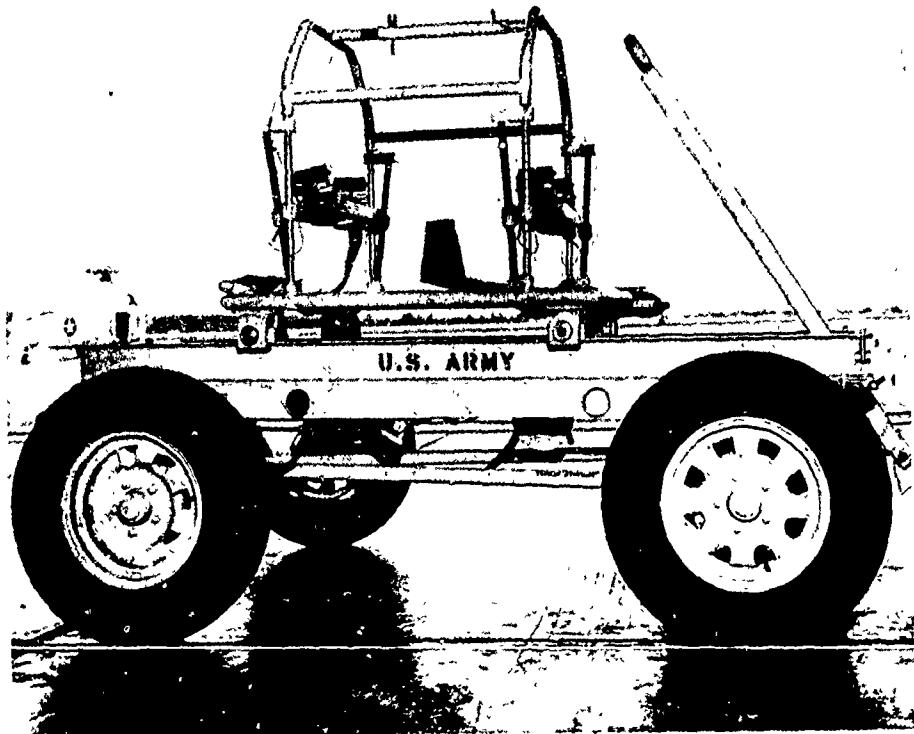


Figure 5. Stores adapter mounted on trailer.

1.2.4. Stores Adapter.

The stores adapter is designed to accommodate external loads, i.e., external fuel tanks and armament loads, carried by Army aircraft. The stores adapter consists of a base frame and an upper frame. Four shafts, perpendicular to the base, contain lock pin holes for positioning the support structure at different heights to accommodate loads of different diameters. The upper frame telescopes onto the side shafts and is held in position by lock pins. The adapter is constructed of aluminum and steel.

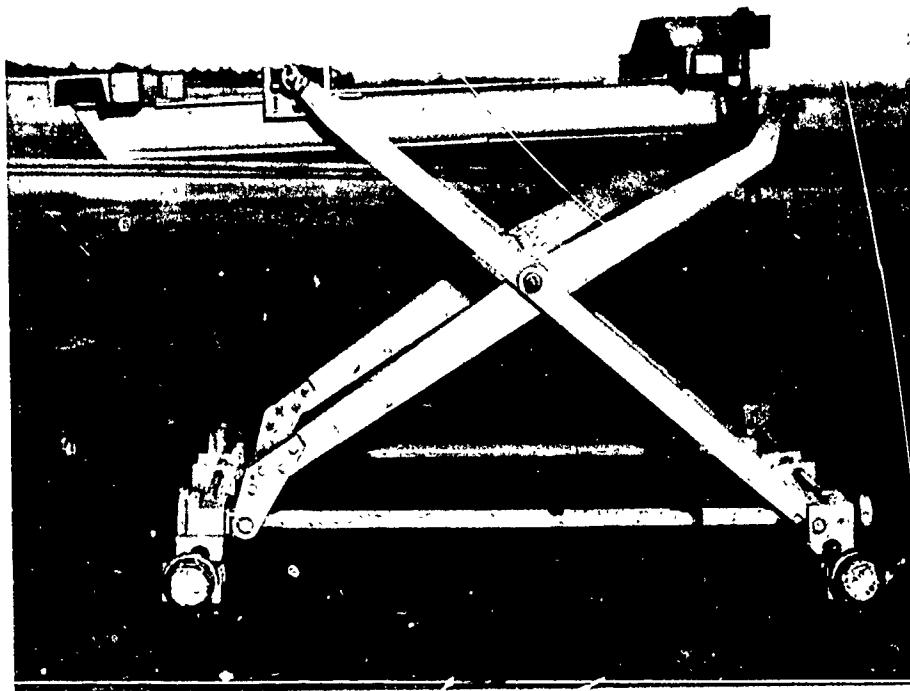


Figure 6. Stores lift unit.

1.2.5. Stores Lift Unit.

The stores lift unit is designed to position the stores adapter and to lift loads for mounting on Army aircraft. The stores lift unit consists of a basic frame, two pairs of scissors, and a scissors actuating mechanism, which permits raising and lowering of the stores adapter and its load. In addition to its raising and lowering capability, the lift unit provides fore and aft tilting, lateral movement, and yaw.

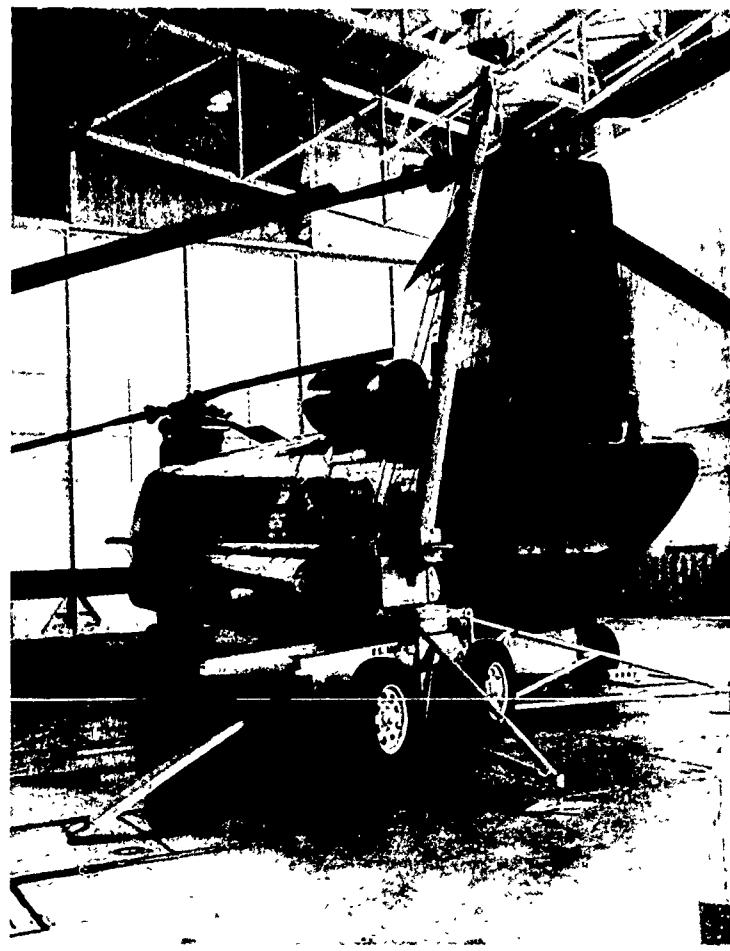


Figure 7. Collapsible crane and outriggers mounted on trailer.

1.2.6. Collapsible Crane.

The collapsible crane is a hand-operated unit which can be used either with or independently of the universal trailer pallet system for positioning adapters on the trailers and components on Army aircraft. The crane has a maximum lift capacity of 1,600 pounds (when load is eight feet or less from centerline) and can traverse 360 degrees. The maximum lift height is 20 feet.

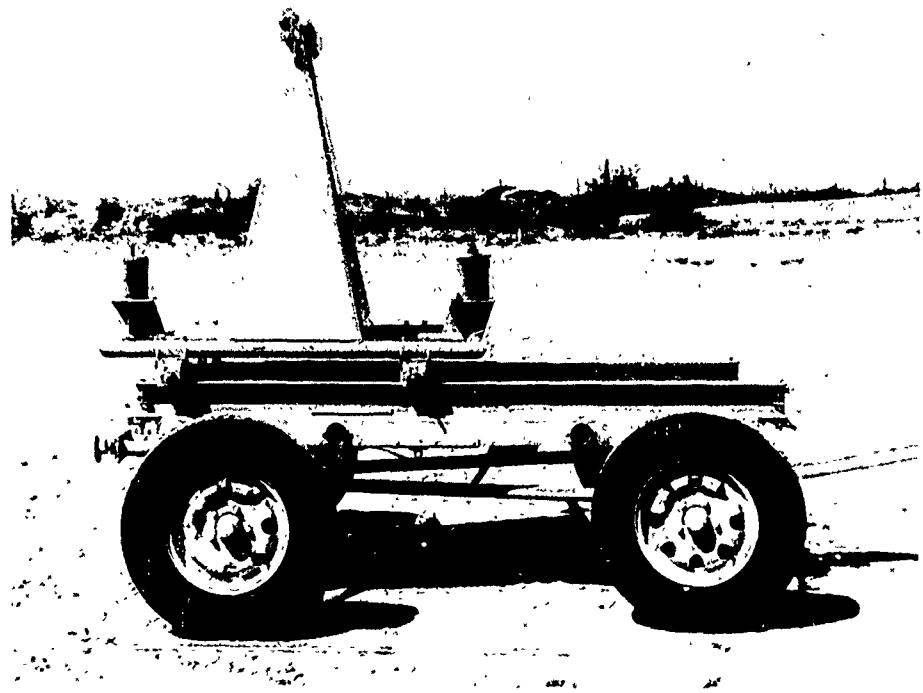


Figure 8. Propeller/rotor hub adapter mounted on trailer.

1.2.7. Propeller/Rotor Hub Adapter.

The propeller/rotor hub adapter is designed to carry propellers used on U-1A, OV-1(), U-6(), U-8(), CV-2(), and CV-7() airplanes and rotor hubs used on the UH-1() and CH-47 helicopters. The adapter is constructed of tubular steel and consists of a pyramid-shaped tower on a rectangular base. The tower is enclosed on all sides with aluminum sheetmetal, which forms a compartment for the spacers and sleeves used with the adapter. Access to the compartment is provided through a hinged door. A pedestal is provided at either end of the base frame for carrying rotor hubs, and the spindle on top of the tower is used for carrying propellers.

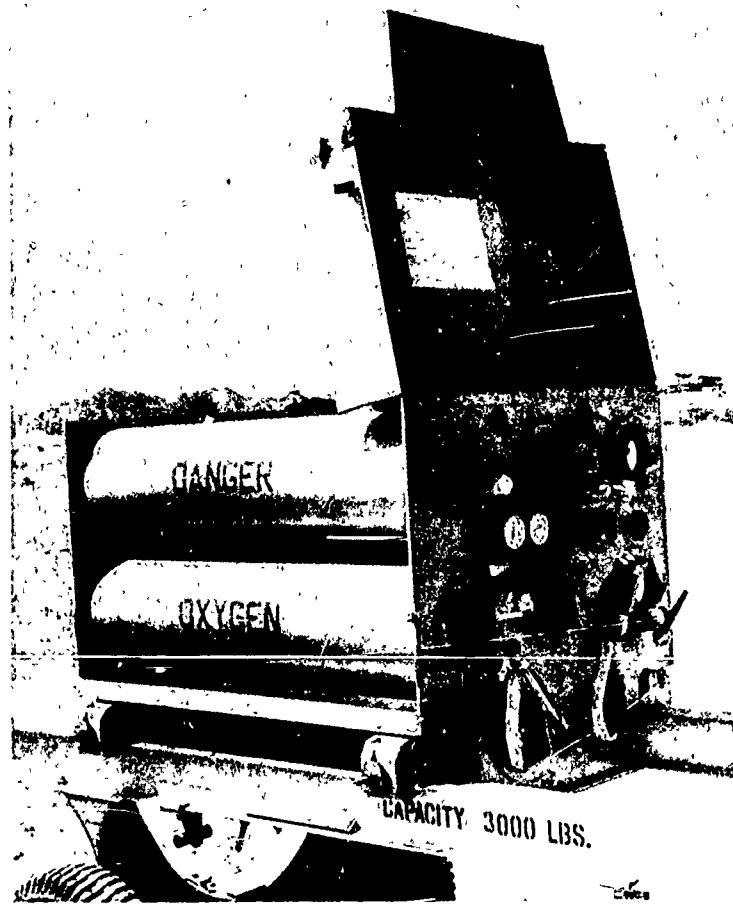


Figure 9. Oxygen servicing unit.

1.2.8. Oxygen Servicing Unit.

The oxygen servicing unit is designed to service Army aircraft oxygen systems. The oxygen servicing unit is eight cylindrical tubes joined at each end with a vertical plate. Each tube can house a standard oxygen bottle. Oxygen is fed from the bottles to a common manifold from which either bottle or regulated-pressure oxygen is available.

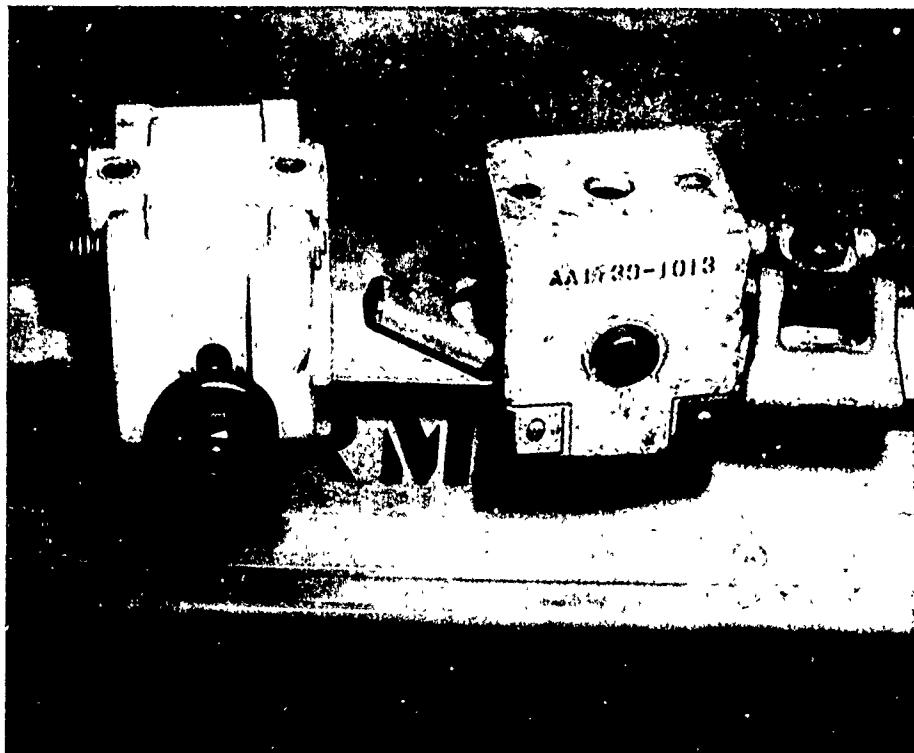


Figure 10. Roller adapters

Left: RA-700

Right: AA1730-1013

1.2.9. Roller Adapter.

The roller adapter is a device which permits carrying equipment to be attached to the rails of the universal trailer pallet system. The adapter permits fore and aft movement of the equipment along the rails. Two different types of roller adapters are provided: AA1730-1013 and RA-700.

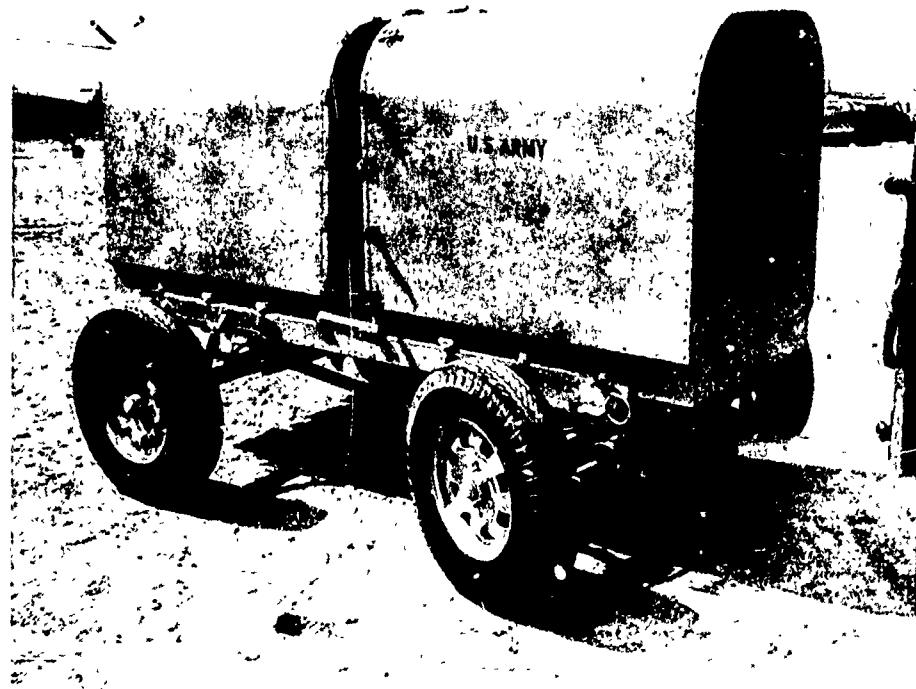


Figure 11. Enclosures mounted on trailer.

1.2.10. Enclosures.

Enclosures (or covers) are available for the universal trailer and pallet. Each enclosure is constructed of laminated fiberglass with straight sides and an arched top. The bottom edges are covered with aluminum molding and a rubber seal. With cam action fasteners, the enclosures can be locked to the trailer or pallet to provide an airtight seal.

1.3. OBJECTIVES.

1.3.1. Purpose.

To determine whether the ASTS is suitable for Army use when operated under temperate, desert, and low-temperature environmental conditions.

1.3.2. Test Objectives.

To determine:

- a. Physical characteristics.
- b. Operational suitability.
- c. Ground-handling characteristics.
- d. Air transportability characteristics.
- e. Maintainability and reliability.
- f. Personnel and training requirements.
- g. Adequacy of the maintenance package.
- h. Under desert environmental conditions, operational suitability, ground-handling characteristics, and maintenance and servicing requirements.
- i. Under low-temperature conditions, operational suitability and ground-handling characteristics.
- j. Whether the ASTS conforms to the Proposed SDR (reference 12, appendix III, section 3).

1.4. SUMMARY OF RESULTS.

1.4.1. Physical Characteristics.

- 1.4.1.1. The weight of the trailer (964 pounds) exceeded that allowed by the Proposed SDR by 314 pounds.

1.4.1.2. All adapters were compatible with the universal trailer.

1.4.1.3. Capacity (1,600 pounds) of the collapsible crane was not sufficient for such items as the CH-54 rotor hub and transmission assemblies.

1.4.1.4. Capacity (2,500 pounds) of the trailer was not sufficient for such items as the CH-54 transmission.

1.4.2. Operational Suitability.

1.4.2.1. The trailer operated satisfactorily.

1.4.2.2. The engine adapter was not compatible with nine of the engines specified in the Proposed SDR.

1.4.2.3. The stores adapter and stores lift unit were unsatisfactory because of excessive height, failure to support loads of rated capacity, and difficulties in tilting the devices.

1.4.2.4. The collapsible crane did not have sufficient capacity or extendible height to perform all required functions.

1.4.2.5. The propeller/rotor hub adapter could not accommodate all required rotor hubs.

1.4.2.6. The oxygen servicing unit performed satisfactorily.

1.4.2.7. Both the AA1730-1013 and the RA-700 roller adapters performed satisfactorily; however, the RA-700, when used with the engine adapter, was not compatible with the enclosures. Roll transfer of adapters required a firm, level surface to prevent misalignment of the trailer rails.

1.4.2.8. The enclosures were satisfactory.

1.4.2.9. Adapters were not provided for transmissions, main-rotor blades, antitorque rotors, and gearboxes.

1.4.3. Ground-Handling Characteristics.

Ground-handling characteristics of the trailer were satisfactory with each of the adapters.

1.4.4. Air Transportability.

The ASTS was air transportable internally in the CH-47, CV-2(), and CV-7() aircraft, except when the propellor adapter was mounted on the trailer.

1.4.5. Maintainability and Reliability.

1.4.5.1. Sixty man-hours of maintenance were required during the temperate test period. There were no features of the ASTS that adversely affected the performance of maintenance.

1.4.5.2. One failure, which appeared to be a problem unique to a prototype item, occurred during the test.

1.4.6. Personnel and Training.

No special training was required for personnel to operate and maintain the ASTS.

1.4.7. Maintenance Package.

The manuals provided for the test were not in standard Army format, but were complete and adequate.

1.4.8. Desert Test.

1.4.8.1. Operational Suitability. The trailers and adapters performed satisfactorily in the desert environment.

1.4.8.2. Ground-Handling Characteristics. The trailer was easily moved by vehicle or manpower over typical desert terrain.

1.4.8.3. Maintenance and Servicing. No unusual maintenance or servicing procedures were required.

1.4.9. Low-Temperature Test.

1.4.9.1. Operational Suitability. The leveling jack mechanism on the trailers failed to operate properly at temperatures of 0°F. and below.

The lubricant specified in the operational and organizational maintenance manual for the adapters was unsuitable at temperatures of -25°F. and below.

1.4.9.2. Ground-Handling Characteristics. No cold damage or other difficulties were encountered in ground handling the trailer at temperatures as low as -65°F.

1.4.10. Comparison with Proposed SDR.

The ASTS met 71 requirements of the Proposed SDR and failed to meet 12 requirements. Ten requirements were not determined. A detailed comparison is contained in appendix I, section 3.

1.4.11. Deficiencies and Shortcomings.

Fourteen deficiencies and 12 shortcomings were discovered during the test.

1.5. CONCLUSION.

The ASTS in its present configuration is not suitable for Army use.

1.6. RECOMMENDATIONS.

None.

PRECEDING PAGE BLANK NOT FILMED

SECTION 2 - DETAILS OF TEST

2.1. INTRODUCTION.

2.1.1. Desert Test.

2.1.1.1. Desert testing of the ASTS was conducted at Yuma Proving Ground, Arizona, during the period 5 July to 18 July 1964. Only the trailer, propeller/rotor hub adapter, and collapsible crane were available for the desert test.

2.1.1.2. Temperatures during the test period ranged from 92°F. to 119°F.

2.1.2. Low-Temperature Test.

2.1.2.1. Low-temperature testing of the ASTS was conducted in the Climatic Laboratory, Eglin Air Force Base, Florida, during the period 4 January 1965 to 12 March 1965. The trailer, engine adapter, collapsible crane, stores adapter, stores lift unit, oxygen servicing unit, and roller adapter were available for the low-temperature test.

2.1.2.2. Testing was accomplished at temperatures of 0°F., -25°F., -45°F., and -65°F.

2.1.3. Temperate Test.

The USAAVNTBD conducted the service test (temperate environment) of the ASTS at Fort Rucker, Alabama. Testing began 15 March 1965 and was suspended 12 May 1965 (reference 8, appendix III, section 3).

2.1.4. Criteria.

The Proposed SDR for Standard Trailer System for Army Aircraft Maintenance (reference 12, appendix III, section 3) was used as a basis for evaluating characteristics of the ASTS.

2.2. PHYSICAL CHARACTERISTICS.

2.2.1. Objective.

To determine the physical characteristics of major components of the ASTS.

2.2.2. Method.

Components of the test system were weighed and measured. Each adapter was mounted on the trailer in the operational and non-operational configuration to check compatibility between the adapters and trailer.

2.2.3. Results.

2.2.3.1. The weights, dimensions, and capacities of the ASTS were:

	Length (in.)	Width (in.)	Height* (in.)	Weight (lb.)	Capacity (lb.)
Trailer	110	70	32	964	2,500
Pallet	60	36	4	150	1,000
Engine adapter	36	38	10 minimum 60 maximum	100	1,600
Stores adapter	48	38	38	150	1,000
Stores lift unit	48	30	3.25 minimum 28.25 maximum	125	1,000
Collapsible crane	168	168	258	1,095	1,600 @ 8 feet** 1,000 @ 10 feet** 500 @ 12 feet**

*Height of the adapter mounted on the trailer is the sum of the adapter and trailer heights except for the collapsible crane.

**Distance from collapsible crane centerline to load.

	<u>Length (in.)</u>	<u>Width (in.)</u>	<u>Height*</u> <u>(in.)</u>	<u>Weight (lb.)</u>	<u>Capacity (lb.)</u>
Propeller/ rotor hub adapter	62	34	53	150	1,000
Oxygen ser- vicing unit	57	34	53	275	1,000

2.2.3.2. All adapters tested were compatible with the universal trailer. However, installation of the crane outrigger was difficult because of insufficient clearance between the outrigger bracing and the trailer spring.

2.2.4. Analysis.

2.2.4.1. The weight of the trailer exceeded that allowed by the Proposed SDR (650 pounds) by 314 pounds.

2.2.4.2. The collapsible crane provides a maximum lift capacity of 1,600 pounds when the load is positioned eight feet or less from the crane centerline. The Proposed SDR specifies that the crane should be capable of lifting all major components for Army aircraft. A minimum capacity of 4,200 pounds would be required to accommodate the CH-54 transmission.

2.2.4.3. The trailer is designed for a 2,500-pound capacity and therefore cannot accommodate all required components.

2.3. OPERATIONAL SUITABILITY.

2.3.1. Objective.

To determine the operational suitability of the ASTS.

2.3.2. Method.

Aircraft components were mounted on and dismounted from the appropriate adapters. The various functions of the trailer and adapters were performed.

*Height of the adapter mounted on the trailer is the sum of the adapter and trailer heights except for the collapsible crane.



Figure 12. Hand could be injured during application of parking brake.

2.3.3. Results.

2.3.3.1. Trailer. The parking brake handle (figure 12) was positioned so that the hand could be injured by the enclosure fastener during brake application. The tow bar, pintle hook, and leveling jacks performed satisfactorily.

2.3.3.2. Engine Adapter.

2.3.3.2.1. The adapter was compatible with the CH-47 (T55-L-5 and -7), UH-1() (T53-L-11), YOH-6A (T63-A-5), OV-1() (T53-L-3 and -7), and the CV-7A (T64-GE-10) engines.

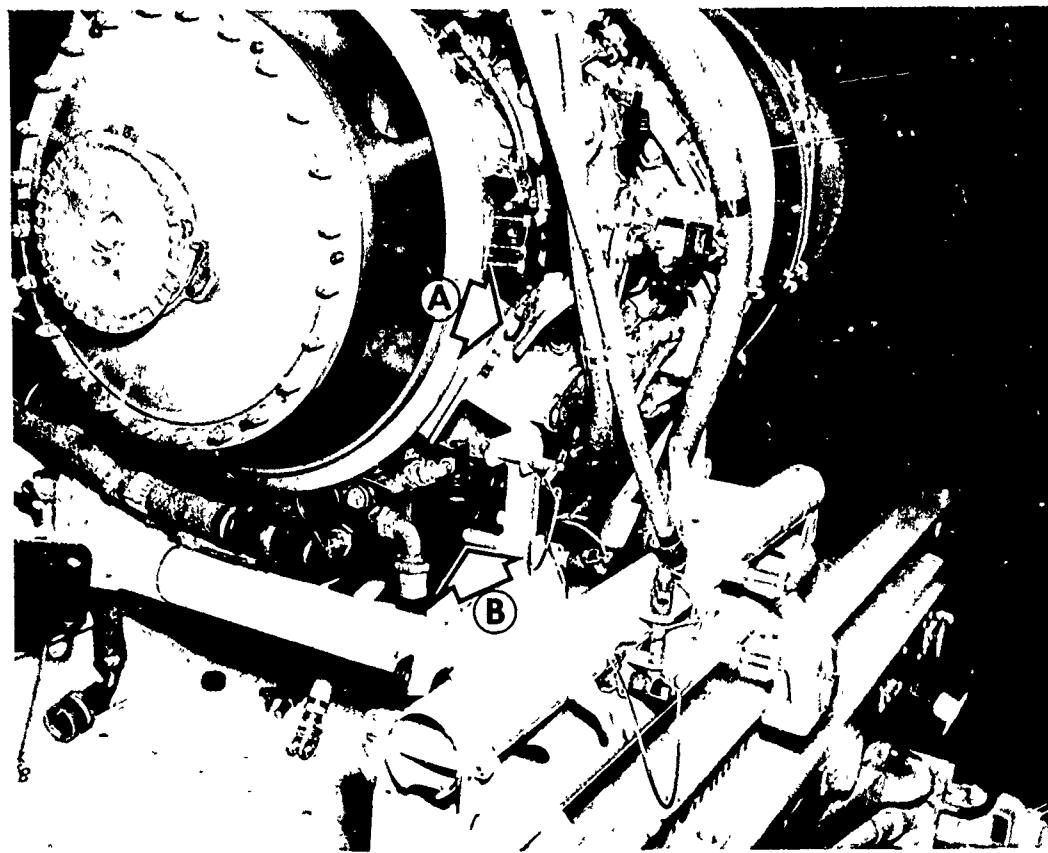


Figure 13. When the engine adapter was used, the linear actuator on the T53-L-11 engine had to be removed (arrow A), and an adapter support pin hit the engine oil screen when the pin was bottomed (arrow B).

2.3.3.2.2. The adapter was compatible with the basic T53-L-11 engine. When installing a built-up engine, however, the linear actuator mounted on the engine had to be removed in order to connect the left-hand mount pad (figure 13). The pin which holds the adapter's left forward support post in position struck the engine oil screen housing when the pin was bottomed (figure 13).

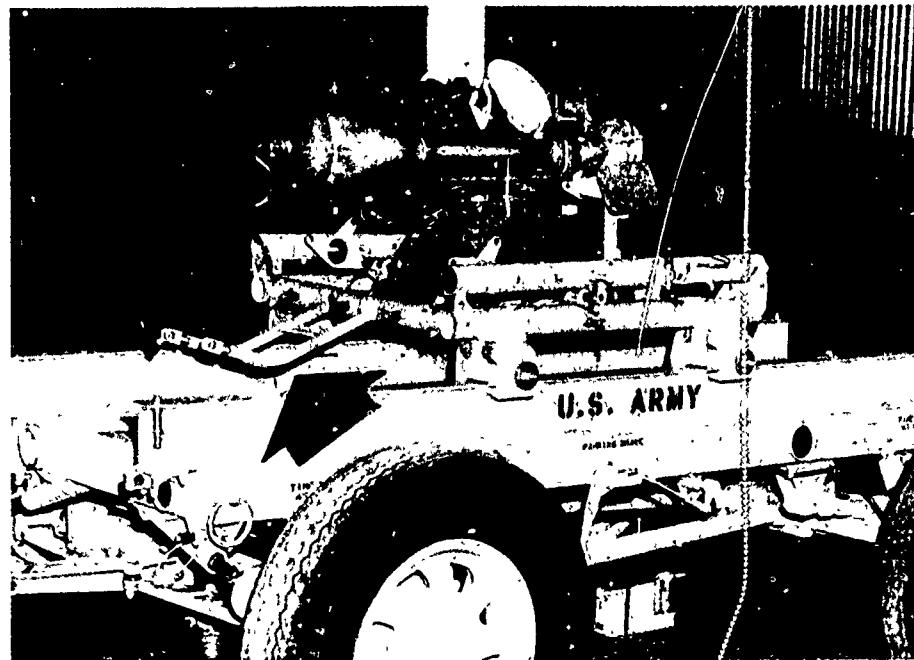


Figure 14. Engine adapter's forward mount (arrow) had to be rotated 180 degrees to install T53, T55, and T63 engines.

2.3.3.2.3. Installation of the T53, T55, and T63 engines (bare) required the adapter's forward mount (used only for the T64 engine) to be rotated 180 degrees to provide adequate clearance (figure 14).

2.3.3.2.4. The adapter was not compatible with the OH-13(), OH-23(), CH-54, O-1(), U-1A, U-6A, U-8D and F, and CV-2B engines.

2.3.3.2.5. The adapter with the RA-700 roller adapters installed was not compatible with the enclosures (figure 15). With the AA1730-1013 roller adapters installed, the engine adapter and enclosures were compatible.

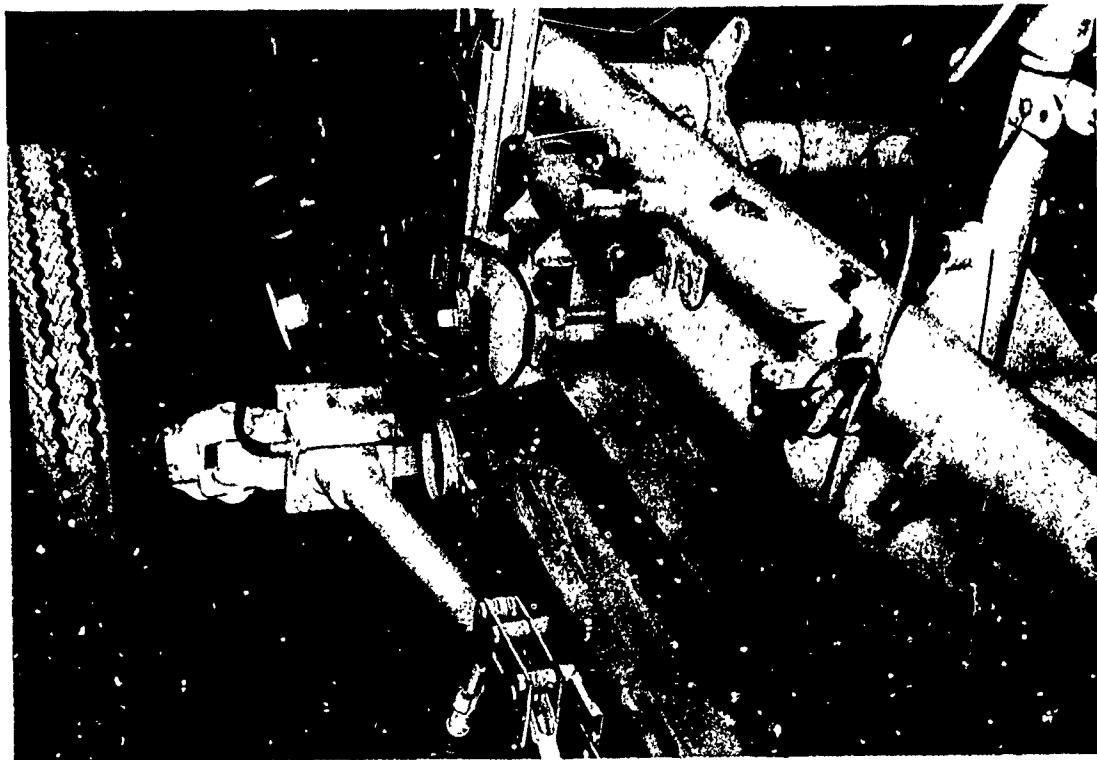


Figure 15. Engine adapter when used with RA-700 roller adapter was not compatible with enclosures.

2.3.3.3. Stores Adapter and Stores Lift Unit.

2.3.3.3.1. These adapters were too high to allow transfer of external stores used on the OV-1() and UH-1() aircraft (figure 16). This was caused by the adjustment of the rollers on the stores adapter for various loads, i. e., the carriage is moved up to decrease and down to increase the width.

2.3.3.3.2. The scissors and ball screw device on the lift unit would not hold loads of near maximum rated capacity (1,000 pounds) at selected heights; the load would lower unless held in position by manpower.

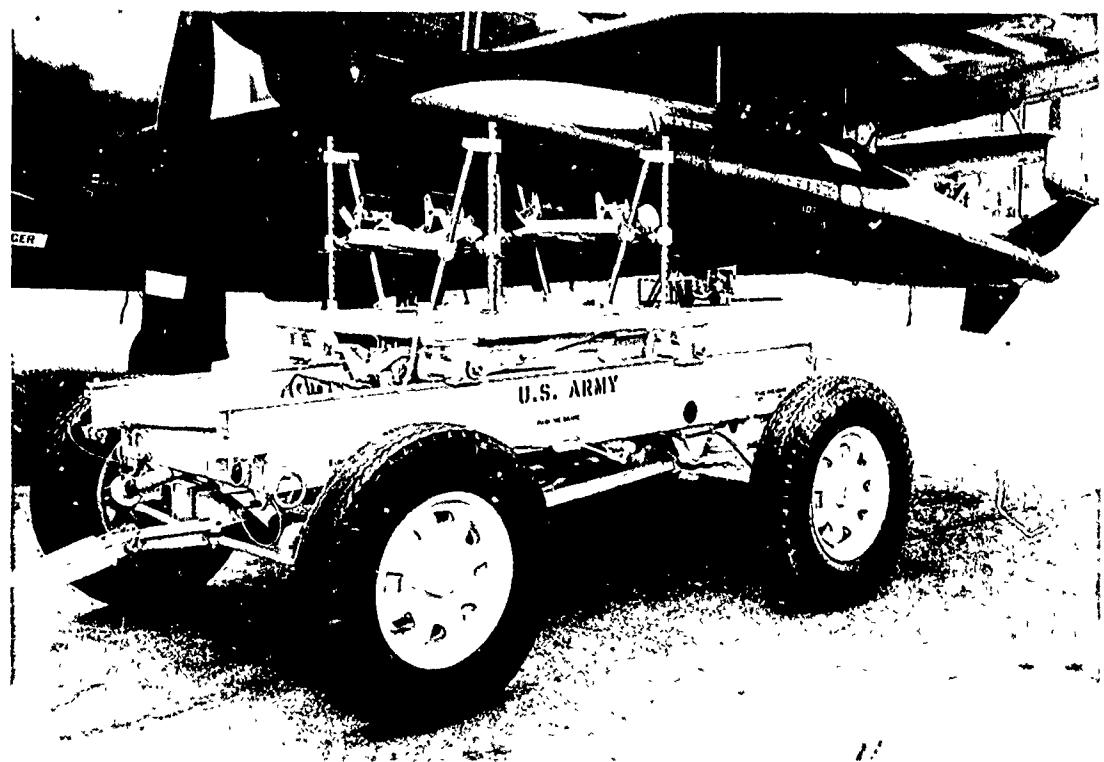


Figure 16. Stores adapter and stores lift unit were too high to allow transfer of external stores used on the OV-1().

2.3.3.3.3. Tilting the lift unit caused the pitch adjustment jack support to contact the lateral movement mechanism, restricting the downward travel of the lift unit (figure 17).

2.3.3.4. Collapsible Crane.

2.3.3.4.1. The crane could not lift all major components of Army aircraft because of its limited capacity (paragraph 2.2.4.2).

2.3.3.4.2. Extendible height (21.5 feet) of the crane was insufficient to position CH-47 or CH-54 hub assemblies on the helicopters.

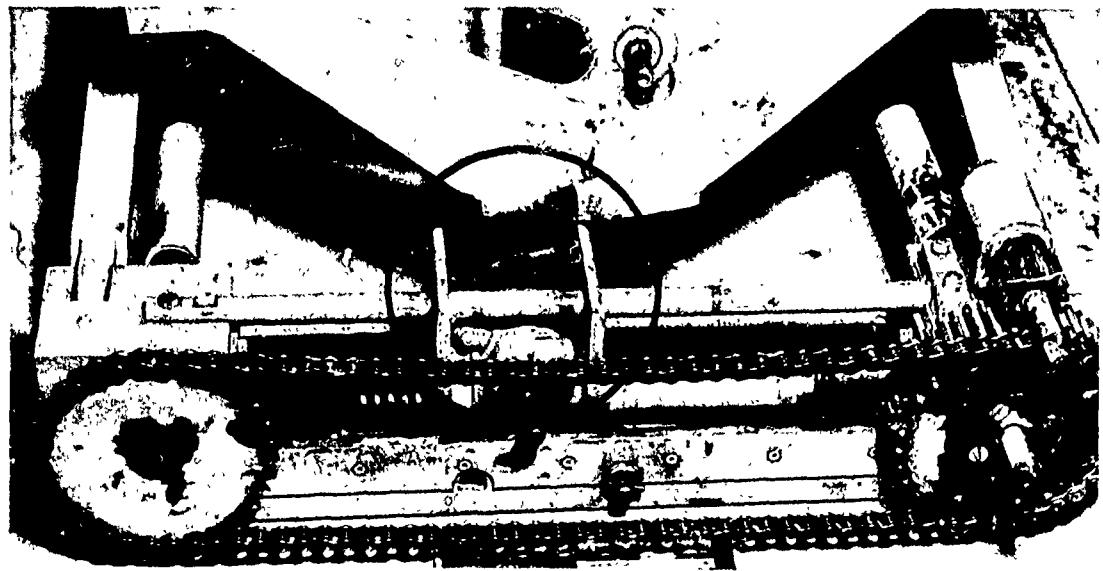


Figure 17. When stores lift unit was tilted, pitch adjustment jack support contacted lateral movement mechanism.

2.3.3.4.3. A fork lift was required to set up the crane independently of the trailer.

2.3.3.4.4. The crane did not have provisions to hold the load in event of failure of the load winch.

2.3.3.5. Propeller/Rotor Hub Adapter.

2.3.3.5.1. The adapter was compatible with the O-1(), OV-1(), U-6A, U-8D and F, and CV-2B propeller assemblies; however, no propeller could be installed with a blade in the vertical-down position without that blade's striking the trailer (figure 18).

2.3.3.5.2. Numerous sleeves and spacers were provided to make the propeller adapter universal. The sleeves and spacers, however, were not identified as to type of aircraft with which they would be used.



Figure 18. Propeller blade in vertical-down position struck the trailer.

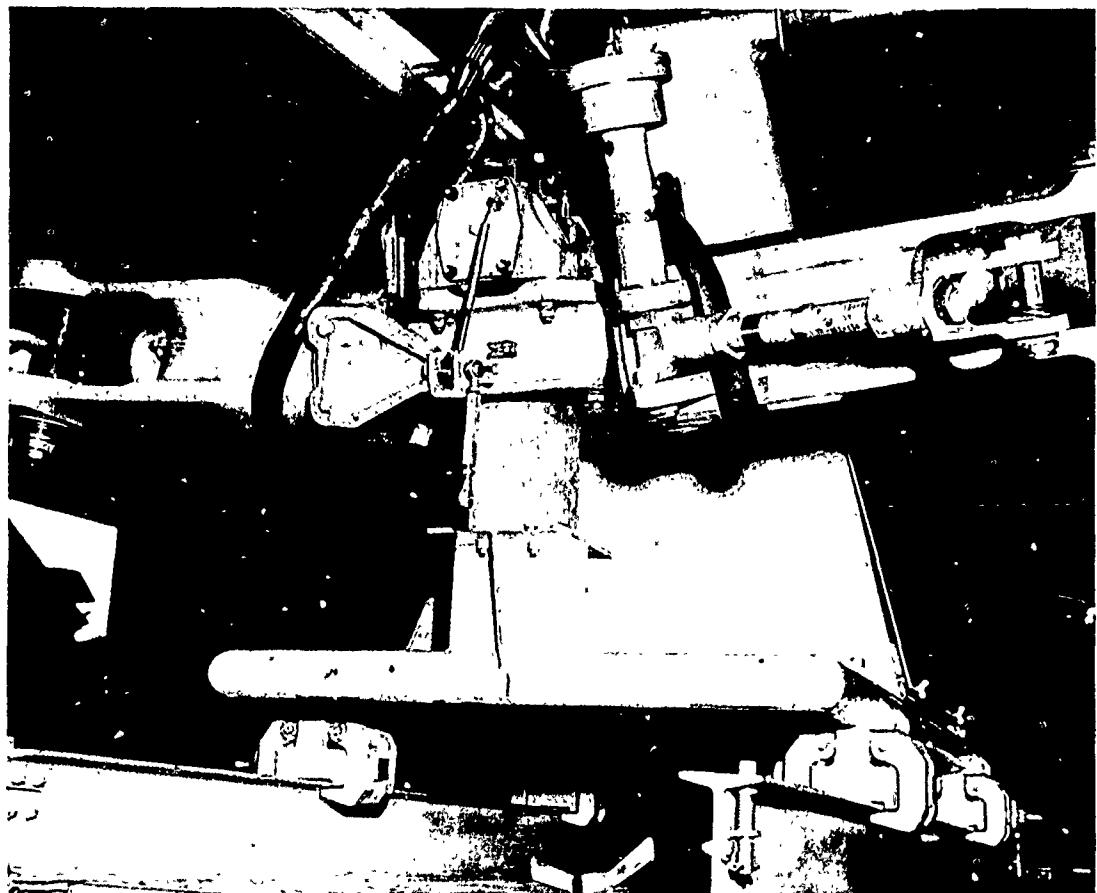


Figure 19. Rotor hub adapter pedestal was too big to accept UH-1() rotor hub.

2.3.3.5.3. The rotor hub adapter was compatible with the CH-47 rotor hub. The UH-1() and YOH-6A rotor hubs would not fit on the adapter because the pedestal was too big (figure 19).

2.3.3.6. Oxygen Servicing Unit.

2.3.3.6.1. The oxygen servicing unit performed satisfactorily using either the bottle pressure outlet valve or the regulated-pressure outlet valve.

2.3.3.6.2. The unit was compatible with the oxygen systems installed in the OV-1(), U-8D and F, and CV-7A aircraft.

2.3.3.7. Roller Adapters.

2.3.3.7.1. Both types of roller adapters (AA1730-1013 and RA-700) furnished with the ASTS performed satisfactorily. When the RA-700 adapter was used with the engine adapter, however, the enclosures could not be mounted.

2.3.3.7.2. A T53-L-7 built-up engine assembly, mounted on the engine adapter, was successfully roll transferred from one trailer to another, using the roller adapters. Roll transfer of adapters required a firm, level surface to prevent misalignment of the trailer rails.

2.3.3.8. Enclosures. The enclosures were satisfactory, but could not be mounted on the trailer with the engine adapter and RA-700 roller adapters. Diffuser tubes and a plenum chamber were not provided with the enclosures.

2.3.3.9. Adapters Not Provided. Adapters were not provided for the following:

- a. Transmission.
- b. Main-rotor blade.
- c. Antitorque rotor.
- d. Gearbox.
- e. Antitorque rotor hub.

2.3.4. Analysis.

2.3.4.1. Trailer. Repositioning of either the parking brake handle or the enclosure fastener would prevent injury to the hand during brake application.

2.3.4.2. Engine Adapter. By providing a shorter pin for holding the left-forward support post, the problem of interference between the oil screen housing of the UH-1() engine and the mount pin can be resolved.

2.3.4.3. Stores Adapter and Stores Lift Unit. Not applicable.

2.3.4.4. Collapsible Crane. The crane would require a minimum lift capacity of 4,200 pounds to lift such items as the CH-54 transmission. In addition, an extendible height of 30 feet would be required to position CH-47 or CH-54 hub assemblies on the helicopters.

2.3.4.5. Propeller/Rotor Hub Adapter. The utility of this adapter can be improved by identifying the aircraft to which the spacers and sleeves apply by aircraft type.

2.3.4.6. Oxygen Servicing Unit. Not applicable.

2.3.4.7. Roller Adapters. Since the AA1730-1013 roller adapters are satisfactory, no requirement exists for the RA-700 adapters.

2.3.4.8. Enclosures. Not applicable.

2.4. GROUND-HANDLING CHARACTERISTICS.

2.4.1. Objective.

To determine the ground-handling characteristics of the ASTS.

2.4.2. Method.

The trailer, with each of the adapters mounted, was towed over hard and soft terrain, hard stand, sand, and mud using a 1/4-ton 4 x 4 vehicle, and moved by manpower on hard and soft terrain and hard stand. Except for the collapsible crane, all adapters were mounted in the operational configuration. The outriggers of the crane were removed for ground handling.

2.4.3. Results.

2.4.3.1. No problems were encountered in towing the trailer with adapters mounted.

2.4.3.2. The trailer was moved by two men on a hard surface. Four men were required on soft terrain.

2.4.4. Analysis.

Not applicable.

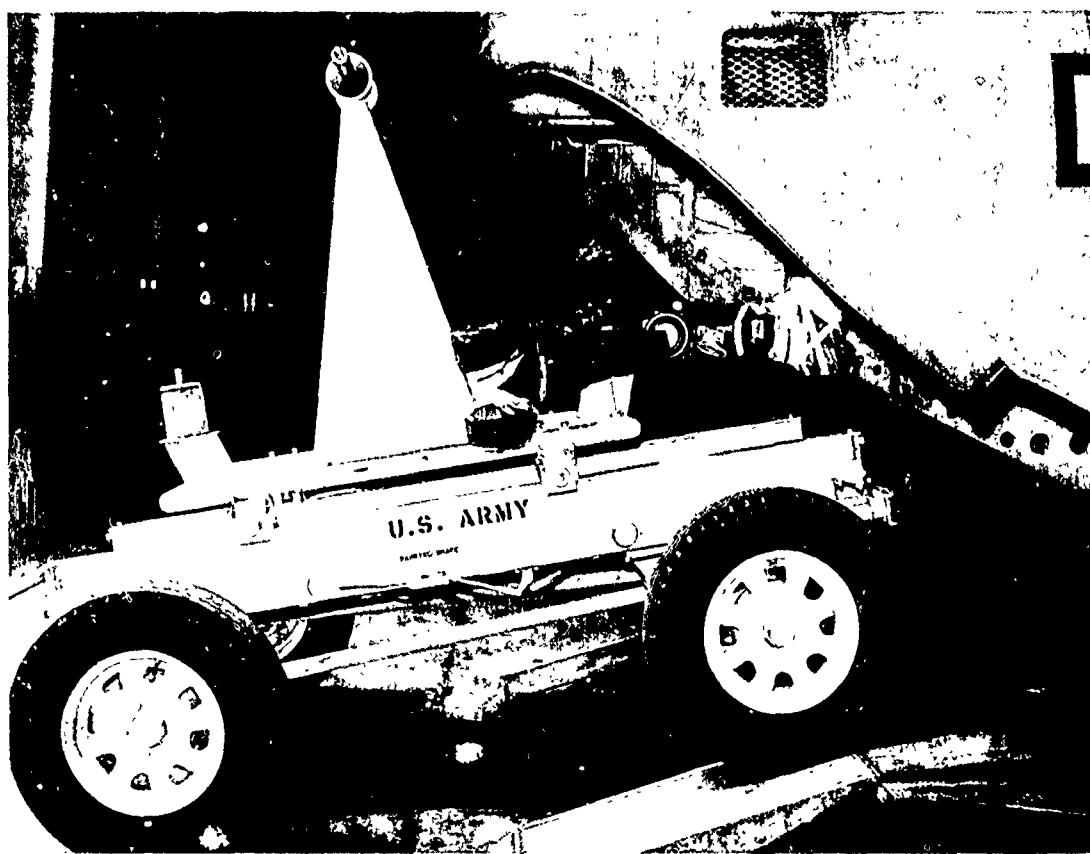


Figure 20. With propeller adapter mounted, trailer could not be internally loaded into CH-47.

2.5. AIR TRANSPORTABILITY.

2.5.1. Objective.

To determine the air transportability of the ASTS.

2.5.2. Method.

2.5.2.1. The trailer, with adapters mounted, was internally loaded in CH-47, CV-2(), and CV-7() aircraft.

2.5.2.2. Using a nylon sling fabricated from two cargo tie-down straps, the trailer, with each of the adapters mounted, was hoist suspended.

2.5.3. Results.

2.5.3.1. With the propeller adapter mounted, the trailer could not be internally loaded into any of the above-listed aircraft. No problems were encountered in loading the trailer with the other adapters.

2.5.3.2. The ASTS was not air transported externally because of the service test's being suspended. Hoist suspension of the trailer and adapters presented no problems.

2.5.4. Analysis.

Not applicable.

2.6. MAINTAINABILITY AND RELIABILITY.

2.6.1. Objective.

To determine the maintainability and reliability characteristics of the ASTS.

2.6.2. Method.

Scheduled and unscheduled maintenance operations and time required, and the mean availability time were recorded and analyzed. Studies were conducted to determine whether maintenance of the system could be improved. Maintenance was performed using tools contained in the standard Aircraft General Mechanic's Tool Kit.

2.6.3. Results.

2.6.3.1. Maintenance required on the ASTS was as follows:

a. Scheduled maintenance - 45 man-hours.

b. Unscheduled maintenance - 15 man-hours.

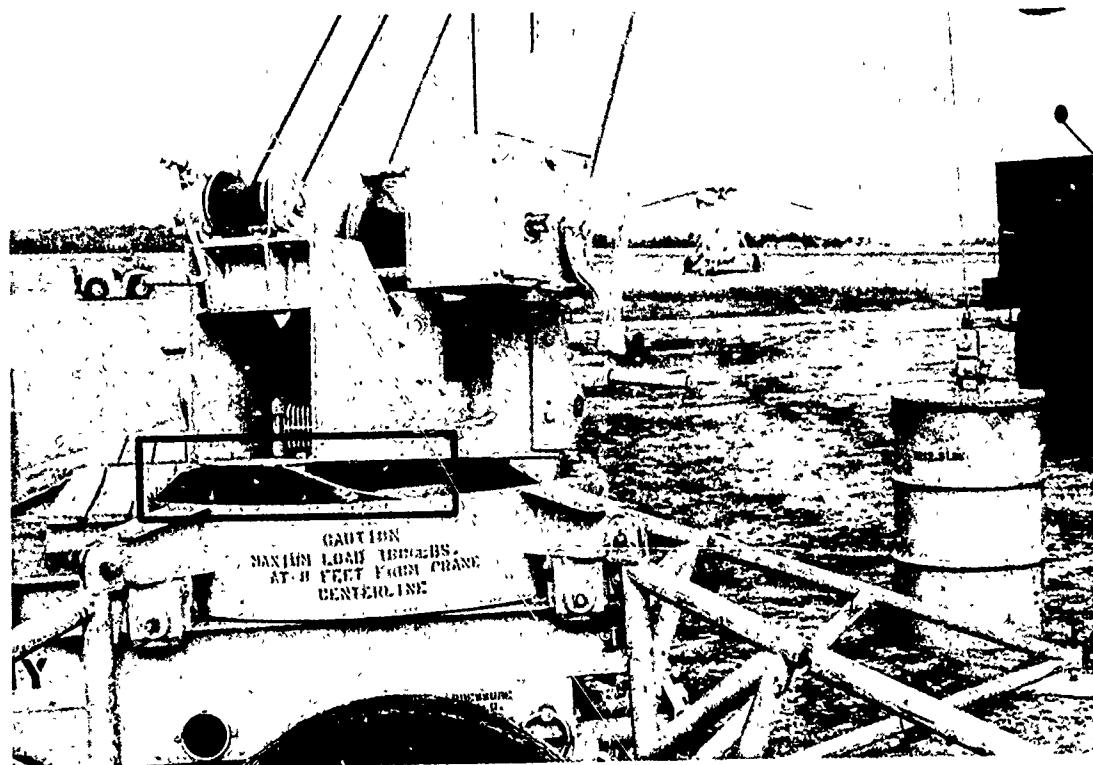


Figure 21. Weld failure of collapsible crane turntable.

Unscheduled maintenance required was repair of a weld failure of the collapsible crane turntable. The failure occurred while the crane was lifting 1212.5 pounds, positioned nine feet from the centerline. The cause of failure was insufficient weld penetration and appeared to be a problem unique to a prototype item.

2.6.3.2. There were no features of the system that adversely affected the performance of maintenance.

2.6.3.3. No special tools were required during the test. Those tools contained in the Aircraft General Mechanic's Tool Kit were adequate for maintaining the ASTS.

2.6.4. Analysis.

On the basis of 60 man-hours of scheduled and unscheduled maintenance for the 90-day test period, the ASTS was available for use an average of more than 23 hours per day.

2.7. PERSONNEL AND TRAINING.

2.7.1. Objective.

To determine whether specialized training is required to utilize and maintain the ASTS.

2.7.2. Method.

Army aircraft mechanics and armorers of various skill levels operated the equipment to determine the training requirements. Aircraft mechanics maintained the ASTS during the test.

2.7.3. Results.

No special training was required for personnel to operate and maintain the ASTS.

2.7.4. Analysis.

Not applicable.

2.8. MAINTENANCE PACKAGE.

2.8.1. Objective.

To determine the adequacy of the ASTS maintenance package.

2.8.2. Method.

The maintenance package was used for maintenance of the ASTS throughout the test period. The contents of the maintenance package were evaluated for completeness and adequacy.

2.8.3. Results.

Two preliminary draft operational and organizational maintenance manuals, one for the adapters and one for the trailer, and a spare parts kit for the trailer were provided. The manuals were not in standard Army format, but were complete and adequate. None of the spare parts were used during the test.

2.8.4. Analysis.

Not applicable.

2.9. DESERT TEST.

Only the universal trailer, the propeller/rotor hub adapter, the collapsible crane, and the roller adapters were available for testing in the desert environment.

2.9.1. Operational Suitability.

2.9.1.1. Objective. To determine the effects of the desert environment on the operational suitability of the ASTS.

2.9.1.2. Method.

2.9.1.2.1. Each adapter was installed and removed from the trailer rails a minimum of two times. This was accomplished manually by roll transfer or by fork lift.

2.9.1.2.2. The propeller/rotor hub adapter was used for transporting a U-1A propeller. The collapsible crane was used for installation of a U-1A engine and propeller, off-loading a PT-6A-6 engine from a CV-2() airplane, and removal and installation of a PT-6A-6 engine in the NU-8F Airplane.

2.9.1.3. Results.

2.9.1.3.1. Each adapter was installed and removed without problems that could be attributed to the desert environment. Roll transfer of adapters from one trailer to another required a firm level surface to prevent misalignment of the rails.

2.9.1.3.2. Each adapter performed its function satisfactorily during the desert environment test.

2.9.1.4. Analysis.

Not applicable.

2.9.2. Ground-Handling Characteristics.

2.9.2.1. Objective. To determine ground-handling characteristics of the ASTS in the desert environment.

2.9.2.2. Method.

2.9.2.2.1. The trailer was towed 163 miles by a 1/4-ton 4 x 4 truck at speeds from 0 to 55 miles per hour. The trailer was carrying a high center-of-gravity (c. g.) load, weighing 1,350 pounds. Surfaces over which the trailer was towed ranged from asphalt and gravel to cross-desert in loose sand. Sixty percent of the mileage was on gravel and unimproved roads. The trailer was towed four miles over a controlled course which included a sixty percent grade slope and twenty percent inclines.

2.9.2.2.2. The trailer with a propeller/rotor hub adapter and collapsible crane was used in the removal and reinstallation of a propeller and engine assembly in a U-1A Airplane that had made a forced landing in the desert test area because of engine failure.

2.9.2.2.3. The trailer was moved by manpower on hard surfaces and sand surfaces.

2.9.2.3. Results.

No problems were encountered in towing the trailer across desert terrain. Two men were required to move the trailer on a hard surface. Four men were required to move the trailer in soft sand.

2.9.2.4. Analysis. The trailer is a stable vehicle which can carry a high c. g. load over desert terrain.

2.9.3. Maintenance and Servicing.

2.9.3.1. Objective. To determine maintenance and servicing requirements peculiar to desert operation.

2.9.3.2. Method. The trailer and adapters were maintained in accordance with the manufacturer's handbook furnished with the equipment. Frequent inspections of the equipment were made with particular attention to the wheel bearings and steering mechanism.

2.9.3.3. Results. No unusual maintenance or servicing procedures were required.

2.9.3.4. Analysis. The trailer will operate in a desert environment with normal maintenance and servicing.

2.10. LOW-TEMPERATURE TEST.

The trailer, engine adapter, stores adapter, stores lift unit, collapsible crane, oxygen servicing unit, and roller adapter were tested in the low-temperature environment.

2.10.1. Operational Suitability.

2.10.1.1. Objective. To determine the operational suitability of the ASTS in a low-temperature environment.

2.10.1.2. Method. All operations listed below were performed at each temperature level ($0^{\circ}\text{F}.$, $-25^{\circ}\text{F}.$, $-45^{\circ}\text{F}.$, $-65^{\circ}\text{F}.$). Personnel operating the equipment wore Type A-12 mittens.

2.10.1.2.1. Trailer. Each adapter was installed on the trailer and operated. The trailer was moved around the Climatic Laboratory, as necessary. The leveling jacks and parking brake on the trailer were used for their intended functions.

2.10.1.2.2. Engine Adapter. The engine adapter with a T53-L-7 engine assembly installed was roll transferred from one trailer to another.

2.10.1.2.3. Stores Adapter and Stores Lift Unit. The stores adapter was fitted with an OV-1() fuel tank filled with JP-4. The lift unit was cycled through its operational spectrum.

2.10.1.2.4. Collapsible Crane. The crane was operated using a T53-L-7 engine (991 pounds) and lead ballast (1,600 pounds) for loads.

2.10.1.2.5. Oxygen Servicing Unit. The oxygen servicing unit was operated from both the direct bottle pressure valve and regulated valve. Loaded to capacity, the unit was roll transferred between trailers.

2.10.1.3. Results.

2.10.1.3.1. Trailer. No damage was found with exception of the leveling jack mechanism on the trailers. This device consists of a two-piece threaded screw mechanism. The outer screw is threaded into the jack housing and acts as an anchor for the inner screw, which is the leveling jack. The lubricants on the threads of these screws congealed when the temperature was lowered, causing the screws to bind together. Binding was first detected at 0°F.

The outer screw is not anchored to the housing. As a result, when the lubricants stiffened, this screw separated from the housing.

2.10.1.3.2. Engine Adapter. The engine adapter performed satisfactorily at all of the temperatures. No problems were encountered in roll transfer of the adapter and engine assembly.

2.10.1.3.3. Stores Adapter and Stores Lift Unit. This unit functioned normally at 0°F., but became hard to operate at -25°F. and progressively harder as temperature was lowered to -45°F. At -45°F., all lubricant (MIL-G-16908) was removed and the parts were relubricated with MIL-G-10924 Automotive and Artillery Grease. After lubrication with MIL-G-10924 grease, the equipment functioned normally at -45°F. and -65°F.

2.10.1.3.4. Collapsible Crane. Using the lubricant (MIL-G-16908) specified in the operational and organizational maintenance manual, the crane functioned normally down to -25°F. At -25°F., because of lubrication problems with the other adapters, the lubricant was replaced with MIL-G-10924 Automotive and Artillery Grease, and no problems were encountered.

2.10.1.3.5. Oxygen Servicing Unit. This unit functioned normally at all temperatures. When the temperature was raised from -65°F. to +70°F., the plastic coating on the service hose peeled.

Roll transfer of the unit was accomplished without difficulty.

2.10.1.4. Analysis.

2.10.1.4.1. The leveling jacks on the trailers should be redesigned to anchor the outer jack screw to the housing with a set screw to prevent separation of the jacks at low temperature.

2.10.1.4.2. The lubricant, MIL-G-16908, specified in the operational and organizational maintenance manual for the adapters was unsuitable at temperatures of -25°F. and below. Automotive and Artillery Grease, MIL-G-10924, is a satisfactory replacement for low-temperature operation.

2.10.2. Ground-Handling Characteristics.

2.10.2.1. Objective. To determine the ground-handling characteristics of the ASTS in a low-temperature environment.

2.10.2.2. Method. The trailers, with adapters, were towed for two hours at each temperature. Wheel bearings, tires, and suspension systems were inspected for cold damage.

2.10.2.3. Results. No cold damage or other difficulties were encountered in ground handling.

2.10.2.4. Analysis.

Not applicable.

2.11. COMPARISON WITH PROPOSED SDR.

2.11.1. Objective.

To compare the characteristics of the ASTS with applicable characteristics of the Proposed SDR (reference 12, appendix III, section 3).

2.11.2. Method.

Throughout the tests outlined previously, the characteristics of the ASTS were compared with a Draft Proposed SDR, dated 30 July 1964, prepared by the US Army Combat Developments Command (USACDC) Transportation Agency. Since later versions of the SDR were received after suspension of the test, the comparison was changed prior to publication of this report to reflect the latest requirements.

2.11.3. Results.

A detailed comparison of the ASTS with the Proposed SDR is contained in appendix I, section 3.

2.11.4. Analysis.

Not applicable.

PRECEDING PAGE BLANK, NOT FILMED

SECTION 3 - APPENDICES

PRECEDING PAGE, BLANK, NOT FILMED

APPENDIX I - FINDINGS

The following is a comparison of the characteristics of the ASTS, as determined by service test, with the characteristics of the draft Proposed SDR (reference 11, appendix III):

<u>SDR</u>	<u>ASTS Met SDR</u>
2. Purpose and Operational Characteristics.	
* * * * *	
b. Operational characteristics.	
* * * * *	
(1) (Essential) The trailer system will consist of a four-wheeled trailer with an articulated suspension system.	No. Suspension system was not articulated.
The trailer frame will incorporate 30-inch rails.	Yes.
(a) The trailer frame will be designed to eliminate the transmission of torque into the payload.	Undetermined; test facilities not available.
(b) The trailer frame will be designed so that terrain irregularities do not create frame distortions.	Yes.
(c) The trailer frame will be designed so that the load carrying frame will not be subjected to torsional and bending forces that will cause distortion.	Undetermined; test facilities not available.
(d) The trailer frame will be designed for maximum resolution of torque forces to bearing surfaces.	Undetermined; test facilities not available.

SDR

ASTS Met SDR

(e) The trailer will be designed so that maximum stability of the center of gravity is attained.

Yes.

(f) The trailer will be designed to be readily assembled and disassembled with tools normally issued in the Army aircraft organizational mechanic's tool set. It will also be capable of being disassembled down into a smaller cube for storage and shipment.

Yes.

* * * * *

(2) (Essential) The rails will be removable from the trailer chassis by quick-disconnect devices or fasteners.

No; the rails were bolted to the trailer chassis.

(3) (Essential) Transfer rails will be equipped with end transfer couplings to facilitate transfer of loads and with end stops to avoid inadvertent movement or slippage of loads during transfer or transport operations.

Yes.

(4) (Essential) Adapters will be designed for multipurpose use as component buildup stands (QCA or nude component). Effort should be expended to combine into one adapter as many functions as possible. The adapters will be capable of being used for component buildup while installed on the trailer, or for use as independent buildup stands when removed from the trailer rails. The trailer and adapters will make up into an assembly

Yes.

SDRASTS Met SDR

to hold components during transport and for use as a base from which components will be directly transferred onto the aircraft. As a minimum, the following adapters will be developed to accommodate applicable components:

(a) The engine adapters will be capable of accepting gas turbine and reciprocating engines for buildup and/or transport and transfer to and from the following aircraft:

Rotary Wing

UH-1 A, B and D	Yes.
CH-47A	Yes.
CH-54	No
LOH	Yes.
OH-13 (all models)	No.
OH-23 (all models)	No.

Fixed Wing

OV-1 A, B and C	Yes.
U-6A	No.
U-1A	No.
O-1A, E, D and F	No.
U-8D and F	No.
CV-2B	No.
CV-7A (if quantity procurement is made)	Not applicable.

(b) The transmission, rotor blade, tail rotor, main gear box and rotor hub adapters will be capable of accepting assemblies for buildup and/or transport and

No. Transmission, rotor blade, tail rotor, and main gearbox adapters were not furnished. The rotor hub adapter would accept only the CH-47A rotor hub.

SDR

ASTS Met SDR

transfer to and from the following aircraft:

UH-1 A, B and D
CH-47A
CH-54
LOH
OH-13 (all models)
OH-23 (all models)

(c) Propeller adapters will be capable of accepting propellers for repair and/or transport to and from the following aircraft:

O-1A, E, D, and F	Yes.
OV-1A, B and C	Yes.
U-6A	Yes.
U-8D and F	Yes.
CV-2B	Yes.
CV-7A (if quantity procurement is made)	Not applicable.

(5) (Essential) Adapters or stands will be attached to and removed from the trailer by quick-disconnect methods.

(6) (Essential) The adapters furnished with the trailer system will be capable of supporting the weight of the heaviest applicable component with a safety factor of 3.

(7) (Essential) Design of the adapters will be such as to permit two men to install and secure one adapter on the trailer in 10 minutes without the benefit of tools, with or

SDR

ASTS Met SDR

without components installed thereon.

(8) (Essential) Each adapter will be capable of being installed on the trailer with a component mounted thereon by use of the integral trailer hoist in 3 minutes.

Yes.

(9) (Essential) The adapters or component stands to be used with the trailer will have the necessary means for safety securing the aircraft components when mounted for transit.

Yes.

(10) (Essential) The adapters or stands will be designed for as many combined uses as possible; for example, one adapter or stand may accommodate more than one type of aircraft component.

Yes.

(11) (Essential) The trailer system will have the capacity of transporting a maximum load equal to the weight of the heaviest component to be transported with a safety factor of 3.

Undetermined.

(12) (Essential) Maximum weight of the trailer, including the rails and running gear, will not exceed 650 pounds.

No; the weight of the trailer exceeded that allowed by 314 pounds.

(13) (Essential) Tire sizes will be interchangeable by simply removing the nuts from the wheel hub and then changing the tire and rim assembly. Low ground

Yes.

SDR

ASTS Met SDR

pressure tires are essential to insure adequate ground flotation in rough terrain.

(14) (Essential) The steering mechanism will have the capability of being manually manipulated by one man for positioning at the aircraft site.

(15) (Essential) The trailer, when fully loaded with the maximum load, will be capable of being manually positioned at the aircraft maintenance site (for example, hardstand, improved surface, pierced steel planking) by two men: one to control the turning radius and the other to push. Jacking facilities will be provided.

(16) (Essential) The trailer will be equipped with a lightweight, retractable tow bar capable of being manually manipulated and compatible with the rear-mounted pintle hooks called for in paragraph (18) (a) below:

(17) The system will possess a lightweight portable hoist for positioning an aircraft component on a trailer equipped with the appropriate adapter and for transfer of the component from ground level or its shipping container onto the stand or from the stand onto the aircraft. The hoist will be capable of lifting the heaviest component to be transported by the trailer. Fail

Yes.

Yes.

Yes.

No; maximum lift capacity of the crane tested is 1,600 pounds. The crane did not have provisions to hold the load in event of failure of the load winch.

SDR

ASTS Met SDR

safe design will be provided to prevent the load from being dropped in the event gears, clutches, or other components fail. If manual operation is used, conventional design of the winch will be employed so that clockwise cranking raises the load and counterclockwise cranking lowers the load. The hoist may require outriggers when the heavier components are being lifted. The hoist components will be collapsible for compact storage and transportation requirements.

(18) (Essential) The system will possess the ground mobility characteristics of Type II mobility as prescribed in MIL-M-8090 except:

(a) The system will have Yes. rear-mounted pintle hooks 14-48 inches from the ground.

(b) The system will be Yes. capable of being towed over unimproved roads and partially improved terrain and will therefore require lightweight uncomplicated brakes and suspension systems. An easily accessible brake lever operable from the ground will be installed on the side of the trailer. Brakes and their equipment will be arranged for rapid inspection and adjustment without removal of trailer components or load.

(19) (Essential) The system Yes. will be capable of being stabilized

SDR

ASTS Met SDR

with suitable leveling devices during a mounting operation or during buildup of a major component.

(20) (Essential) Maximum safety provisions will be made for personnel and equipment during operation, storage, transportation, and maintenance of the system.

Yes.

(21) (Essential) Particular emphasis will be placed on the ability of the system to perform safely for extended periods with only scheduled organizational maintenance and without failure of adapters or integral major components.

Yes.

(22) (Essential) Each trailer system will be air transportable as an internal load within the CV-2B/CH-47A.

Yes; except trailer with propeller adapter mounted could not be internally loaded.

(23) Each trailer system will be capable of being transported with maximum load as an external sling load by Army cargo transport helicopters. Maximum load is weight of the trailer with the heaviest aircraft component installed thereon.

Undetermined.

(24) (Essential) Suspension points will be provided that are compatible with the standard sling suspension system used with each Army cargo transport helicopter. Suspension provisions for external transport by helicopter sling load will allow the sling or web strap to be inclined at an angle 45° from the

Yes.

SDR

ASTS Met SDR

vertical toward the center of gravity of the suspended item when a force equal to the weight of the item is exerted on any or all sling webs or straps.

(25) (Essential) Suspension points used for transport of the system as a helicopter external sling load will also be capable of being used as tiedown points when the system is transported as an aircraft internal load. Yes.

(26) (Essential) The system will be capable of rapid displacement and resumption of operation at new locations. Yes.

(27) (Essential) Provisions will be made for securing all components of the system for air transport so that no damage will occur and so that it can be placed in immediate operation after air delivery. Yes.

(28) (Essential) The system will be designed to meet the following requirements of AR 705-15, "Operation of Materiel Under Extreme Conditions of Environment."

(a) The trailer system will be designed to operate under intermediate climatic conditions as defined in paragraph 7 of Change 1 to AR 705-15. Yes.

(b) Construction materials used will provide maximum resistance to the harmful effects of Undetermined.

SDR

ASTS Met SDR

rodents, insects, fungi, humidity, rain, snow, ice, salt water, mud, blown sand, and wind and will have a useful life span of at least 10 years. Materials will provide adequate resistance to rust, corrosion, and deterioration in service and storage. Standard wheels, tires, and other running gear parts and components will be used to the maximum extent practical. Small components, when directly interchangeable, will be AN series standard.

(29) (Essential) The trailer system will be sufficiently rugged to withstand military use without servicing between scheduled maintenance inspections as described in paragraph c(9) below. Yes.

(30) (Essential) All maintenance points on the trailer such as grease fittings, brake adjustments, will be readily accessible without the need to remove covers to implement the servicing actions. All bearings which move and other friction items will have readily accessible provisions for greasing or oiling, if required. Yes.

(31) (Essential) During system design, requirements for future aircraft component adapters will be considered. Adapter design should cover anticipated requirements for at least 10 years after the aircraft has been introduced in the Army inventory. Provision will be made in the system design for inclusion of potential new adapter kits which Undetermined.

SDR

ASTS Met SDR

can be utilized without requiring modifications to the trailer.

c. Operational information.

* * * * *

(2) Turnaround time. Not applicable or defined in paragraph 6b(2) of AR 705-25. There will be no servicing or checkout requirements between activities.

(3) Reaction time. Reaction time for this equipment is from the moment an operator decides to employ the system until it is ready for operation.

(a) Required: 10 minutes (includes time needed to install adapter). Yes.

(b) Desired: 5 minutes. Yes.

* * * * *

(5) Combat-ready rate. Each system must be maintained in a constant state of operational readiness and must be capable of instantaneous employment.

(a) Required: 96 per-cent. Yes.

(b) Desired: 99 per-cent. Yes.

* * * * *

SDR

ASTS Met SDR

(7) Required mission duration. The system is to be used for buildup of major aircraft components and for handling and transporting these components before and after repair.

The system will be capable of constant or intermittent use during a 20-hour day. The number of buildups and handlings to be performed in 1 day cannot be estimated. Yes.

A specific mission, exclusive of time required to deliver the component from one site to another, is as follows:

(a) For engine buildup:

1. Install or remove basic engine on adapter and trailer:

Required: 10 minutes Yes.

Desired: 5 minutes Yes.

2. Remove engine and adapter from trailer:

Required: 10 minutes Yes.

Desired: 5 minutes Yes.

(b) For transmission and rotor assembly buildup install

SDR

ASTS Met SDR

or remove transmission or rotor assembly on adapter and trailer:

Required: 10 minutes

Yes, to the extent that adapters were available.

Desired: 5 minutes

Yes, to the extent that adapters were available.

(c) For handling and transporting the engines, transmissions, and rotor assemblies:

1. Install component on adapter and trailer:

Required: 10 minutes

Yes, to the extent that adapters were available.

Desired: 5 minutes

Yes, to the extent that adapters were available.

2. Transport from one site to another: dependent upon maintenance procedures.

3. Remove component from adapter and/or trailer (time applicable to all components):

Required: 10 minutes

Yes, to the extent that adapters were available.

Desired: 5 minutes

Yes, to the extent that adapters were available.

(8) Planned utilization rate. The utilization rate is dependent upon the type of maintenance where the system is to be employed.

Yes.

SDR

ASTS Met SDR

Because the trailer system will be used at the direct support and general support maintenance levels, the planned utilization rate of the system is 20 hours per day.

(9) Mean downtime allowable. Downtime allowable is the time required to perform scheduled and unscheduled maintenance, provided servicing materials, repair parts, maintenance inspection will be accomplished after each 6 months of system operation. Lubrication of wheel bearings and other moving parts will, if required, be accomplished every 6 months as a part of the scheduled inspection. Items requiring lubrication will be lubricated with standard lubricants currently in the Army inventory. Besides lubrication, scheduled maintenance will require only visual inspection. Repairs will be accomplished within the following time frame:

(a) Organization maintenance:

Required: 30 minutes Yes.

Desired: 15 minutes Yes.

(b) Direct support:

Required: 6 hours Yes.

Desired: 4 hours Yes.

SDRASTS Met SDR

(c) General Support:

Required: 12 hours. Yes.

Desired: 8 hours. Yes.

(10) Reliability after storage. Not determined.

The system must be capable of safe storage and transportation without permanent impairment of its capabilities from the effects of extreme conditions. After depot storage, not more than 2 man-hours of maintenance will be required to put the system into operation; after field storage, not more than 1 man-hour of maintenance.

(11) Minimum time allowable between scheduled maintenance will be as specified in paragraph (9) above. Yes.

(12) Test and checkout methodology. It is desired that the equipment be designed so as to be as maintenance-free as possible throughout its service life. The system will be designed so that all checkout will be accomplished without use of special tools. Yes.

(13) Maintenance personnel. Aircraft mechanics of the 670 series will provide maintenance support. Yes.

* * * * *

SDR

ASTS Met SDR

5. Maintenance Concept. It is essential that the trailer system possess the following maintenance characteristics:

- a. The system will be designed for minimum preventive and in-storage maintenance. To satisfy this requirement, modular, multi-purpose component assemblies will be used where possible. Design for ease of maintenance should not take precedence over design for functional reliability. Yes.
- b. The system will be designed for maximum interchangeability and use of standard components, parts, and modules, where feasible. Standard aircraft type hardware will be used where possible in order to assure compatibility with standard aircraft maintenance tools. Yes.
- c. Throwaway assemblies or modular design will be used wherever cost per assembly is under \$25.00 each or when value analysis for higher cost items dictates. However, components, parts, and assemblies will be designed to be repairable in the field with standard aircraft maintenance repair equipment, materials, and parts, insofar as possible or practical. Yes.
- d. Minimum allowable time between scheduled maintenance will be as specified in paragraph 2c(9) above. Yes.

SDR

ASTS Met SDR

e. A reasonable minimum variety and quantity of replacement modules and repair parts will be stocked at organizational level.

Not determined.

f. Maximum time allowable for diagnosing failures will be:

(1) Organizational maintenance: 5 minutes. Yes.

(2) Direct support maintenance: 15 minutes. Yes.

(3) General support maintenance: 25 minutes. Yes.

* * * * *

PRECEDING PAGE, BLANK, NOT FILMED

APPENDIX II - DEFICIENCIES AND SHORTCOMINGS

A. Deficiencies. The following deficiencies were discovered during this test:

<u>Deficiency</u>	<u>Suggested Corrective Action</u>
1. Trailer suspension system was not articulated.	None.
2. Engines for the following aircraft could not be installed on the engine adapter: OH-13(), OH-23(), CH-54, O-1(), U-6A, U-1A, U-8D and F, and CV-2B.	Either redesign the present adapter or provide an adapter for these engines.
3. Rotor hubs for the following helicopters could not be installed on the rotor hub adapter: OH-13(), OH-23(), YOH-6A, UH-1(), and CH-54.	Either redesign the present adapter or provide an adapter for these rotor hubs.
4. A transmission adapter was not provided with the test equipment.	None.
5. A rotor blade adapter was not furnished with the test equipment.	None.
6. A tail-rotor adapter was not provided with the test equipment.	None.
7. A gearbox adapter was not provided with the test equipment.	None.
8. Extendible height of crane was insufficient to position all components on aircraft.	Lengthen crane boom.
9. Crane did not have provisions for a fail-safe feature.	Redesign crane to include fail-safe feature.

<u>Deficiency</u>	<u>Suggested Corrective Action</u>
10. The trailer weight exceeded that specified in the Proposed SDR.	None.
11. The trailer and crane did not have sufficient capacity to accept all required aircraft components.	Increase trailer and crane capacity.
12. Stores adapter was too high to accommodate the stores on the OV-1() and UH-1().	Redesign adapter so it will accommodate the stores on Army aircraft.
13. The stores lift unit would not hold loads of near maximum rated capacity at selected heights.	Redesign adapter to hold loads up to maximum rated capacity.
14. Roll transfer of loads required a firm, level surface to prevent misalignment of the rails.	None.

B. Shortcomings. The following shortcomings were discovered during this test:

<u>Shortcoming</u>	<u>Suggested Corrective Action</u>
1. When placed in the "down" position, propeller blade struck trailer frame.	Modify propeller adapter to provide blade clearance.
2. Engine adapter linear actuator mount had to be removed from UH-1() engine to install the engine on the adapter.	Redesign adapter.
3. Mounting pin for the left forward support post on the engine adapter could strike the oil screen of a UH-1() engine mounted on the adapter.	Shorten pin.

<u>Shortcoming</u>	<u>Suggested Corrective Action</u>
4. Propeller adapter sleeves were not marked.	Color code or mark sleeves according to use.
5. Installation of the crane outriggers was difficult because of insufficient clearance between the outrigger bracing and the trailer spring.	Redesign outrigger frame so that it can be installed without striking the trailer spring.
6. The parking brake handle on the trailer was positioned so that the hand could be injured by the enclosure fasteners during brake application.	Reposition either the parking brake handle or the enclosure fastener.
7. When used with the engine adapter, the RA-700 roller adapter was not compatible with the enclosures.	Since the AA1730-1013 roller adapter performed satisfactorily, delete the RA-700 roller adapter from the system.
8. Tilting the stores lift unit caused the pitch adjustment jack support to contact the lateral movement mechanism, restricting the downward travel of the lift unit.	Redesign unit to provide adequate clearance between pitch adjustment jack support and lateral movement mechanism.
9. Diffuser tube and a plenum chamber were not provided with the enclosures.	Provide diffuser tubes and plenum chamber.
10. The preliminary draft operational and organizational maintenance manuals were not in the standard Army format.	None.
11. The jack screws on the leveling jack mechanism began to bind at a temperature of 0°F, and as the temperature was lowered, the outer jack screw separated from the housing.	Anchor the outer jack screw to the housing with a set screw.

Shortcoming

12. The lubricant, MIL-G-16908, specified in the operational and organizational maintenance manual for the adapters was unsuitable at temperatures of -25° F. and below.

Suggested Corrective Action

Revise the manual to prescribe use of Grease, Automotive and Artillery, MIL-G-10924, at temperatures of -25° F. and below.

APPENDIX III - REFERENCES

1. TCTC 3831, Task 9M89-20-001-06, "Universal and Multi-purpose Trailers and Pallet System (U), Initiation," 12 September 1961.
2. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 23 March 1964, subject: "USATECOM Project No. 7-4-0458-01, Military Potential Test of Airfield Specialized Trailer System."
3. Operation and Maintenance Manual, "U. S. Army Universal Trailer Model MP 7692 (Contract No. DA-23204-AMC-02866T)," Astro-Science Corporation, Support System Division, June 1964.
4. Desert Test Outline, USATECOM Project No. 7-4-0458-01, Airfield Specialized Trailer, US Army Aviation Test Board, 7 July 1964.
5. "Draft Proposed Small Development Requirement for Standard Trailer System for Army Aircraft Maintenance," US Army Combat Developments Command Transportation Agency, 30 July 1964.
6. Message, AMSTE-BC TT15157, Commanding General, US Army Test and Evaluation Command, 9 September 1964, subject: "USATECOM Project No. 7-4-0458-01, Mil Potential Test of Airfield Specialized Trlr System."
7. Plan of Test, USATECOM Project No. 4-4-5100-01, "Service Test, Airfield Specialized Trailer System," US Army Aviation Test Board, 29 March 1965.
8. Message, AMSTE-BG APG7757, Commanding General, US Army Test and Evaluation Command, 12 May 1965, subject: "Airfield Specialized Trailer System, USATECOM Project No. 4-4-5100-01."
9. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 27 May 1965, subject: "USATECOM Project No. 4-4-5100-01, Service Test, Airfield Specialized Trailer System."
10. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 12 August 1965, subject: "USATECOM Project No. 4-5-5009-22/23/24 Military Potential Test of Model 689 Army Aircraft Maintenance Trailers."

11. Letter, CDCMR-O, Headquarters, US Army Combat Developments Command, 17 September 1965, subject: "Draft Proposed Small Development Requirement (SDR) for Standard Trailer System for Army Aircraft Maintenance."
12. "Proposed Small Development Requirement for Standard Trailer System for Army Aircraft Maintenance," US Army Combat Developments Command, 21 January 1966.
13. Plan of Test, USATECOM Project No. 4-5-5009-22, "Service Test, Model 689 Army Aircraft Maintenance Trailer," US Army Aviation Test Board, 1 April 1966.
14. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 2 May 1966, subject: "Engineering and Service Test Plans of Test of Model 689 Army Aircraft Trailer, USATECOM Project No. 4-5-5009-22/23/24."
15. Message, SMOSM-EGGG-1325, Commanding General, US Army Aviation Materiel Command, 11 July 1966, subject: "USATECOM Project 4-4-5100-01."
16. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 20 July 1966, subject: "Service Test, Army Specialized Trailer System."
17. Report of Test, USATECOM Project No. 4-5-5009-22, "Service Test of the Model 689 Army Aircraft Maintenance Trailer," US Army Aviation Test Board, 21 July 1966.
18. Preliminary Draft Technical Manual, "Operational and Organizational Maintenance Instruction, Airfield Specialized Trailer," US Army Aviation Materiel Command, undated.
19. Manual, "Operational and Organizational Maintenance Instructions for Engine Adapter Model E-1600; Stores Adapter Model S-1000; Lift Unit Model L-1000; Collapsible Crane Model C-1600; Propeller Adapter Model P-1000; Oxygen Servicing Unit Model O-800; Roller Adapter Model RA-700," Washington Technological Associates Inc., undated.

APPENDIX IV - DISTRIBUTION

USATECOM PROJECT NO. 4-4-5100-01

<u>Agency</u>	<u>Final Report</u>
Commanding General US Army Test and Evaluation Command ATTN: AMSTE-BG Aberdeen Proving Ground, Maryland 21005	30
Commanding General US Army Materiel Command ATTN: AMCRD-DF-S Washington, D. C. 20315	2
Commanding General US Army Combat Developments Command ATTN: CDC USATECOM LnO Aberdeen Proving Ground, Maryland 21005	11*
Commanding General US Army Mobility Command ATTN: AMSMO-RDS Warren, Michigan 48090	2
Commanding General US Army Aviation Materiel Command ATTN: SMOSM-GCRP P.O. Box 209, Main Office St. Louis, Missouri 63166	2
Commanding General US Army Aviation Materiel Command ATTN: SMOSM-EGG P.O. Box 209, Main Office St. Louis, Missouri 63166	5

*Distribution will be made from those copies forwarded to USATECOM.

<u>Agency</u>	<u>Final Report</u>
President US Army Airborne, Electronics and Special Warfare Board Fort Bragg, North Carolina 28307	1
Commanding Officer US Army Aviation Test Activity Edwards Air Force Base, California 93523	1
Commanding Officer Yuma Proving Ground Yuma, Arizona 85364	1
Commanding Officer US Army Arctic Test Center APO Seattle, Washington 98733	1

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) US Army Aviation Test Board Fort Rucker, Alabama 36360		2a. REPORT SECURITY CLASSIFICATION Unclassified
2b. GROUP		
3. REPORT TITLE SERVICE TEST OF THE AIRFIELD SPECIALIZED TRAILER SYSTEM (U)		
4. DESCRIPTIVE NOTES (Type of report and Inclusive dates) Final Report of Test, July 1964 through May 1965		
5. AUTHOR(S) (Last name, first name, initial) Wheeler, Robert J., Major, TC Cumb, Raymond F., Mr.		
6. REPORT DATE October 1966	7a. TOTAL NO. OF PAGES	7b. NO OF REFS 19
8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S) USATECOM Project No. 4-4-5100-01	
b. PROJECT NO. RDT&E Project No. 1D141812D18506	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
c.		
d.		
10. AVAILABILITY/LIMITATION NOTICES US military agencies may obtain copies of this report directly from DDCI. Other qualified users shall request through Commanding General, US Army Materiel Command, Washington, D.C. This document may be further distributed by my holder only with specific prior approval of Headquarters, US Army Materiel Command.		
11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY US Army Materiel Command Washington, D.C. 20315	
13. ABSTRACT The US Army Aviation Test Board service tested the Airfield Specialized Trailer System (ASTS) to determine its suitability for Army use. Desert testing was conducted at Yuma Proving Ground, Arizona, during July 1964; low-temperature testing was conducted in the Climatic Laboratory, Eglin Air Force Base, Florida, during January - March 1965; and temperate testing was conducted at Fort Rucker, Alabama, during March - May 1965. Testing was suspended in May 1965 and cancelled in July 1966. The ASTS failed to meet the Proposed Small Development Requirements in 12 areas. Fourteen deficiencies and 12 shortcomings were discovered during the test. It was concluded that the ASTS in its present configuration is unsuitable for Army use. No recommendations were made. (U)		

UNCLASSIFIED

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
USAAVNTBD	Personnel					
Service test	Training					
Desert	Maintenance package					
Low-temperature	Small Development					
Temperate environment	Requirements					
Airfield Specialized Trailer System						
Physical characteristics						
Operational suitability						
Ground handling						
Air transportability						
Maintainability						
Reliability						
Servicing						
INSTRUCTIONS						
1. ORIGINATING ACTIVITY: Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization (<i>corporate author</i>) issuing the report.	10. AVAILABILITY/LIMITATION NOTICES: Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:					
2a. REPORT SECURITY CLASSIFICATION: Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.	(1) "Qualified requesters may obtain copies of this report from DDC."					
2b. GROUP: Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.	(2) "Foreign announcement and dissemination of this report by DDC is not authorized."					
3. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.	(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through ."					
4. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.	(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through ."					
5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.	(5) "All distribution of this report is controlled. Qualified DDC users shall request through ."					
6. REPORT DATE: Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.	If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.					
7a. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.	11. SUPPLEMENTARY NOTES: Use for additional explanatory notes.					
7b. NUMBER OF REFERENCES: Enter the total number of references cited in the report.	12. SPONSORING MILITARY ACTIVITY: Enter the name of the departmental project office or laboratory sponsoring (paying for) the research and development. Include address.					
8a. CONTRACT OR GRANT NUMBER: If appropriate, enter the applicable number of the contract or grant under which the report was written.	13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.					
8b, 8c, & 8d. PROJECT NUMBER: Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.	It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as (TS), (S), (C), or (U).					
9a. ORIGINATOR'S REPORT NUMBER(S): Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.	There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.					
9b. OTHER REPORT NUMBER(S): If the report has been assigned any other report numbers (<i>either by the originator or by the sponsor</i>), also enter this number(s).	14. KEY WORDS. Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, rules, and weights is optional.					

UNCLASSIFIED

Security Classification